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Instructional Strategies

Joan Ferrini-Mundy, Ph.D. • July 2008

Topic: National Math Panel: Critical Foundations for Algebra
Practice: Comprehensive Instruction

Highlights

- Discussion of instructional strategies and their potential for improving mathematics achievement
- Understanding when and how to use real-world problems
- Brief summary of the research findings related to technology
- Using computer-assisted instruction to teach computational skills
- Role of teacher's professional judgment in instructional decision-making

About the Interviewee

Dr. Joan Ferrini-Mundy served as Ex-Officio Member of the National Mathematics Advisory Panel and as Co-Chair of the Instructional Practices Task Group. She is the Division Director of the National Science Foundation's (NSF) Division of Elementary, Secondary, and Informal Education, in the Directorate for Education and Human Resources. In this role she supports NSF's mission of providing leadership and promoting development of the infrastructure and resources needed to improve pre-kindergarten through twelfth grade science, technology, engineering, and mathematics education throughout the United States. While on assignment at NSF, Dr. Ferrini-Mundy serves as a University Distinguished Professor of Mathematics Education at Michigan State University (MSU) and Associate Dean for Science and Mathematics Education in the College of Natural Science. She is a professor in the Departments of Mathematics and Teacher Education.

Ferrini-Mundy's research interests include calculus teaching and learning, the development and assessment of teachers' mathematical knowledge for teaching, and the improvement of student learning in K-12 mathematics. She has played leadership roles in several MSU-based projects, including the Carnegie-supported Teachers for A New Era Initiative, the NSF-funded Knowledge of Algebra for Teaching project, and Promoting Rigorous Outcomes in Mathematics/Science Education (PROM/SE), an NSF Mathematics and Science Partnership.

Full Transcript

I am Joan Ferrini-Mundy and I work currently at the National Science Foundation as Director of the Division of Research on Learning in Formal and Informal Settings. I am fortunate to be here on an IPA, which is an Intergovernmental Personnel Act appointment from my home institution, which is Michigan State University, where I am a member of the mathematics education faculty.

So the task group looked at a number of specific areas and had some interesting findings about several of these. We examined the use of "real-world problems" in mathematics teaching and learning. That is, the idea of offering a problem that's based in a context that might be familiar or motivational to the students. The research that has looked at the use of real-world contexts as a setting for learning mathematics has suggested that when that sort of approach to mathematics teaching is used, students' performance on tests that actually ask them to apply the mathematics in real-world settings can be improved and enhanced. However, students' performance on more standard mathematical tests, tests of computation or equation solving, is less likely to be different if they have been introduced through the real-world problem setting. Why does it happen that working with real-world problems as a motivation for the mathematics can lead to improved performance on the real-world problems, but not on the sort of straight mathematics, the core mathematics necessarily? And I think that's still an open question in research. I don't think it's a reason for shying away from the use of real-world problems or problems given in context, but rather, it would require, I think, a deeper look into instruction and the different parts of instruction that bring out the actual mathematical computations or concepts that need to be brought out in the context of solving real-world problems.

Teachers have very good judgment and can sense from their students and their assessments when it's important to try to motivate a mathematical topic with an applied context or a real-world problem, and when it might be more efficient to simply move more directly to the mathematics in a direct instruction kind of way. One of the additional topics that the team looked at was the use of technology in mathematics teaching and learning, and in particular, we looked at the use of calculators and the role of calculators in supporting mathematics learning. The set of studies that we found was small; there were 11 studies and most of them were quite old, done, in fact, with technology that's now become passe. Nonetheless, the findings from those studies did not indicate that there was any particular impact of technology on the improved performance of students in mathematics, particularly in the area of computation. What the report calls for is increased research using current technologies, using strong research designs that can examine these questions more fully. We also looked at research about computer-assisted instruction, tools particularly to help students learn to do computation, and found that those kinds of tools show promise on the basis of research in enabling students to perform better on computational tasks. Essentially, these are drill-and-practice programs that give students experience in doing mathematical computation.

So, again, in technology as with many areas, the verdict is still unclear in terms of the exact nature and role and most optimal ways of using technology to support mathematics learning. I think there is something that you can say about teachers using good judgment, and teachers recognizing that we do need kids to be computationally fluent. If technology is used as a crutch or a tool that prevents them from being able to become computationally fluent, that certainly isn't helping students with their mathematics learning. At the same time, the technologies could perhaps be useful for interesting exploration and for other kinds of applications, and I think what we are going to need is just much more research and much more careful examination of their potential.